

CLAIMS

1. A dewatering system for separating substantially clean liquid from a mixture of the liquid and a contaminating substance intimately mixed with the liquid, consisting of a circulation ring to receive the contaminated liquid in contained relation therein; the ring having a circulation path for circulating passage of contaminated liquid therearound; liquid transfer means for transferring the contaminated liquid into the circulation ring; pump means for circulating the contaminated liquid about the ring circulation path; cross-flow filter means having filter membrane surfaces forming a part of the ring circulation path, for receiving the liquid in cross-flow penetrating relation thereacross; liquid receiver means for receiving the penetrating liquid from the filter means; pressurizing means for creating a predetermined pressure drop across said cross-flow filter means, to promote passage of said liquid through said filter means; chemical cleaning means for cleaning said filter means; and control means for admitting chemicals of said cleaning means to said ring and removing said chemicals from said ring.
2. The system as set forth in Claim 1 wherein said contaminated mixture is a mixture of water with oil.
3. The system as set forth in Claim 1, wherein said chemical cleaning means includes a plurality of chemical reservoirs, said control means including individual control means for each of said reservoirs.
4. The system as set forth in Claim 1, including at least two auxiliary reservoirs, one of which is connected directly with said ring, and one being directly connected with said liquid receiver means, wherein said auxiliary reservoirs

receive said cleaning chemicals in sequential transfer relation, wherein said chemicals are sequentially flushed through said filter membrane surfaces in reversing trans-membrane directions.

5. The system as set forth in Claim 1, wherein said cross-flow filter means consists of a single ceramic cross-flow filter element held within a stainless steel housing.

6. The system as set forth in Claim 1, having a pair of said circulation rings, wherein said cross-flow filter means consists of a single cross-flow filter in each said ring.

7. The system as set forth in Claim 1, wherein said cross-flow filter means consists of at least one ceramic cross-flow filter element held within a stainless steel housing.

8. The system as set forth in Claim 7, said circulation ring having more than one said cross flow filter means, connected in series flow relation.

9. The system as set forth in Claim 4 said at least two auxiliary reservoirs having air supply means connected thereto in selective liquid displacing relation, to pass said cleaning chemicals in said sequential transfer relation, for oscillating displacement through said filter membrane surfaces.

10. The system as set forth in Claim 1, wherein said liquid transfer means for transferring said contaminated liquid into said circulation ring includes a pressurized feed tank having a high level switch, a low level switch, and pressure air supply means controlled by said switches, enabling entry of said contaminated liquid into said tank at substantially atmospheric pressure, on

actuation of said low level switch, with pressurization of said tank at a pressure above atmosphere upon actuation of said high level switch.

11. The system as set forth in Claim 5, wherein said single ceramic cross-flow filter element is sealed within said stainless steel housing by way of double O-ring seals, to withstand reversals in pressure of said cleaning chemicals.

12, A dewatering system for separating substantially clean liquid from a mixture of the liquid and a contaminating substance intimately mixed with the liquid, consisting of a circulation ring to receive the contaminated liquid in contained relation therein; the ring having a circulation path for circulating passage of contaminated liquid therearound; liquid transfer means for transferring the contaminated liquid into the circulation ring; pump means for circulating the contaminated liquid about the ring circulation path, when energized; cross-flow filter means having filter membrane surfaces forming a part of the ring circulation path, for receiving the liquid in cross-flow penetrating relation thereacross; liquid receiver means for receiving the penetrating liquid from the filter means; pressurizing means for creating a predetermined pressure drop across said cross-flow filter means, to promote passage of said liquid through said filter means; and back pressure means, operable on de-energization of said pump means, to terminate passage of said liquid through said filter means, and to apply backpressure to liquid within said liquid receiver means to thereby suffuse said liquid over said filter membrane surfaces, in protective relation from said contaminated liquid.

13. The system as set forth in Claim 12, wherein said backpressure means includes a compressed air reservoir in actuating relation with an outlet valve for said liquid receiver means and with an inlet valve connected in back-pressure applying relation with said liquid receiver means.

14. The method of extracting substantially clear permeate liquid from a contaminated mixture of said liquid and a low concentration of globular contaminant, using a cross-flow filter located within a circulatory ring apparatus containing said mixture, including the steps of filling said ring with said contaminated mixture; circulating said mixture around said ring at a sufficient pressure to promote the passage of said liquid as a permeate through said filter in a first direction, while maintaining the passage of said contaminant across the face of said filter; removing said permeate from the apparatus; draining said ring; admitting a cleaning liquid to the ring, and circulating same about the ring under a pressure acting to effect passage of said liquid in said first direction; reversing said pressure to effect passage of said liquid in a direction reverse to said first direction as a cleaning oscillation; repeating said cleaning oscillation; draining said cleaning liquid from the ring; readmitting contaminated mixture to the ring, and repeating said steps.

15. The method as set forth in Claim 14, including the step of rinsing said ring with water prior to the initial said filling step; and after draining said cleaning liquid from said ring.

16. The method as set forth in Claim 14, including the step of monitoring the

removal of said permeate, to determine the rate of permeate through-put in relation to a thresh-hold level, and initiating a cleaning sequence commencing with said step of draining said ring, to promote said rate of permeate throughput.

17. The method as set forth in Claim 16, including the step of further monitoring said removal of said permeate, to determine the rate of permeate through-put in relation to said thresh-hold level, and initiating a further cleaning sequence commencing with said step of draining said ring, to further promote said rate of permeate throughput.

18. The method as set forth in Claim 16, wherein said step of circulating said mixture around said ring includes electrically energizing a pump means to circulate said mixture; including, in the event of said pump means becoming de-energized, the steps of terminating said removal of permeate from said apparatus, and applying air pressure to said apparatus to displace said permeate in suffusing relation across said face of said filter, in protective relation with said face against penetration of said contaminated mixture into said face.